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The Study on Emergency Management System of Supergiant Water Resources and Hydropower Projects

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Abstract

With the completion of the Three Gorges Project, the supergiant water resources and hydropower construction has entered a new time. However there still are many problems in supergiant water resources and hydropower construction, especially in emergency management. The paper mainly study on the development of emergency management system in the supergiant water resources and hydropower construction, including the function module and the system architecture of the emergency management system. The paper presents a platform which has the complete function module and the advanced system architecture. It can provide guidance and assistance for many water resources and hydropower companies.

Keywords: Supergiant water resources and hydropower projects; Emergency management system; Safety management

1. Introduction

With the rapid economic development of our society and the deepening concept of taking people as the foremost, harmonious society in project development, national and social put forward the higher security requirements in the supergiant water resources and hydropower construction. The supergiant water resources and hydropower construction are confronted with many serious issues as complicated geological conditions, the labor personnel-intensive, high-altitude cross-operation of large equipment, construction is becoming increasingly difficult, the level of supervision team can not be fully meet the requirement, the quality of construction workers should be improved, construction and monitoring of major accident hazards urgent need to improve, the different level of safety construction and management. Therefore, it is very difficulty to protection of the safety of supergiant water resources and hydropower construction. Also, the supergiant water resources and hydropower projects are usually responsible for the flood control, power generation, navigation, water supply and many other aspects of effect, directly

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related to public safety, so the construction of the supergiant water resources and hydropower projects safety has attracted worldwide attention. So it is very important to safety management of the project studying on emergency management system of supergiant water resources and hydropower project.

2. The development and application of emergency management system

2.1 The development of emergency management system

1) Database. Emergency management system has wide data sources and large amount data, so it must use large database management system. Oracle is currently the more popular of the large-scale database management systems; it has powerful data processing, analysis, higher scalability, reliability and security.

2) Development tools. To make emergency management systems to run on different platforms, so cross-platform development tools must support the application development. The greatest feature of JAVA is cross platform and also supports dynamic Web, Internet computing. Java is widely accepted and promoted the rapid development of Web, popular browsers now support Java applet.

2.2 The application environment of emergency management system

1) Server. According to safety and emergency management information system needs assessment on the host system, proposed the following building programs. The initial host system configuration plans are shown in Table 1.

Table 1 the number of servers on internet

No.	Item	Quantities
1	Application Server	2
2	GIS Server	2
3	Database Server	2
4	File Server	1
5	Backup Server	1
6	Video Conferencing Server	1
7	Image Access Server	1
8	Secure Server	1
9	Other Servers	2
10	Data Integration Server	1

The Application Server will use two dual-host windows system, the basic configuration requirements are as follows:

Rack Server; CPU: physical CPU, expandable to 4 physical CPU, dual-core, main frequency more than 2.4GH; Memory: 16GB, expandable to 64G, ECC; built-in hard disk capacity: two 146GB hot plug hard drives, support for internal RAID, the cache of array card more than 512MB, with battery protection; two 1000M Ethernet cards; Operating System: Support for multiple operating systems (LINUX, Windows).

The configurations of other servers are not going to repeat them.

2) Client. Emergency management system uses the B / S architecture, the client only need to support the browser. We recommended using Microsoft's Internet Explorer browser.

3. Emergency Management System Analysis

3.1 Organizational Structure of the emergency management system

Emergency response organizations are composed with the emergency command center, emergency management office, on-site emergency command post, various protection functions and support departments, professional emergency rescue teams and social support security forces, expert groups, related agencies, other emergency response agencies and the rescue teams. Among them, the Emergency Command Center has overall responsibility for emergency management. It is the highest emergency response command center to deal with unexpected events. Furthermore, to set up emergency management offices, centralized management of emergency work. It is the head office when start the emergency plan. The site emergency command Department is set up in the emergency field command structure. The institution is under the leadership of the emergency command center and the site has overall responsibility for emergency response work.

3.2 The Business Process Analysis of Emergency Management System

After the accident, the people in the accident scene shall immediately report to the person in charge of the company. People responsible for construction projects received the report shall immediately report to the supervision unit and the supervision units received the report shall immediately report to their respective construction management department. According to state regulations, we first need to determine the accident level then according to different levels of the accident required to report to the city, provincial, national and other related departments within the specified time.

According to the accident level, the construction company starts the appropriate emergency plans to handling emergency incidents. The construction company must report the accident at any time when processing the accident. After processed accident, the emergency recovery and assessment need to be done. At the same time, since the date of the accident within 30 days, if the number of casualties caused by the accident changed, it shall be reported immediately. Traffic accidents and fire accidents, since the date of the accident within 7 days, the number of casualties caused by the accident changed, it shall be reported immediately.

3.3 The Function Module of Emergency Management System

The Emergency Management System are consisted with eight function module, the specific functional modules and the development model used as shown in table 2:

Table 2 the function module of system

No.	Module Name	Development Model
1	Emergency Duty	B/S
2	Video Surveillance	B/S
3	Precaution	B/S+C/S
4	Emergency Plan Management	B/S
5	Expert Consultations and Decision Support	B/S
6	Emergency Resources Management	B/S+C/S
7	Emergency Recovery and Post-assessment	B/S
8	Simulation Exercises	B/S

Emergency duty module is to achieve the functions that the relevant departments and subsidiaries report the incident to the head corporation. The head corporation receives the reports and verified. The head corporation generated the accident information according to a number of different sources of information. To achieved the head corporation managing the daily duty shifts, duty records and correspondence.

Video surveillance module is to achieve showing the control point data, voice and image. The module transports the data which are collected in the incident to the monitoring center through Internet or Intranet. It can show the incident scene on the big screen TV, so the command authority and leadership can see the scene in the monitoring center, can know the incident in time, can carry out emergency command, can enhance rapid response capacity.

Precaution module is to achieve early warning of public emergencies, trend forecasting and comprehensive judgments. The assistance of the relevant departments, the precaution module forecasts possible secondary, derived events, to determine the sphere of influence, the way of affected, duration and extent of harm based on the current information available, the use of comprehensive prediction model for quick calculations, and the consequences of developments in the simulation analysis. Then it can propose the early warning advices related to relevant warning grading index.

Plan management module is to achieve helping preparation emergency plans for the office of emergency management. It can transfer text plans to structured digital plans and inquiry, maintain the digital plans.

Expert consultations and decision support module is to provide the incident programs and send to all execution unit based on comprehensive event information, events surrounding the information, leadership instruction, expert advice, event-related emergency plans, event-related emergency knowledge, relevant laws, relevant emergency cases, assisted model and the information which is related to other models, such as the scheduling plans which are produced from emergency resource management, situation map etc.

Emergency resource management and scheduling module is mainly used for scheduling the emergency resource of public events during the course of the rescue forces, relief supplies, rescue equipment, emergency specialists, medical power, etc. The module shows the amount of resource, location and distribution intuitively to the emergency commander and provides aids and tools for emergency commander developing resource scheduling program by using information tables and geographic information system.

Emergency recovery and post-assessment module is to achieve recovering the emergency site, environment and assessing the whole process of the accident by using event evaluation indicators.

Simulation exercise module is an important part of emergency management. It can improve emergency response capabilities and provide reference to testing and modifying emergency plans. It can also be used for training of relevant personnel. Simulated training modules can build public emergency scene, simulate and analysis the event, record the exercise process automatically and assess the effects of exercise and other business process modules in the implementation. The head corporation can use simulated training modules to simulate exercises scene that happened accidents frequently, simulate and analysis the disposal of accident hazards, improve the emergency response command staff to do emergency response capacity to respond to disasters and test and modify relevant emergency response plan.

3.4 The Overall framework of Emergency Management System

The emergency management information system based on advanced multi-layer structure model and the MVC (Model-View-Controller) pattern. The multi-layer structure can built loosely coupled, easy to re-use, scalable applications and in addition to facilitate the organization and implementation of software development, but also to facilitate future system maintenance and expansion. The MVC model, the model

component encapsulates core data and functionality, so that the core functionality can independent of the output and input methods. The view components obtain information from the model and display to the user. The controller components connect with only one view component and accept user input. The emergency management information system which using application framework is very flexible and adapt to changing functional user interface requirements through the model, view and controller separated.

4. Conclusions

At present, China water resources and hydropower engineering emergency management information system construction is in the initial stage. The research and development on water resources and hydropower engineering emergency management information system is very important. It can promote the information construction of water resources and hydropower engineering management and raise the level of safety management in water resources industry. The paper mainly studies design and architecture of the large hydroelectric engineering emergency management system. It is highly advanced, universal, reality and can provide helping for many construction of hydroelectric engineering emergency management systems.

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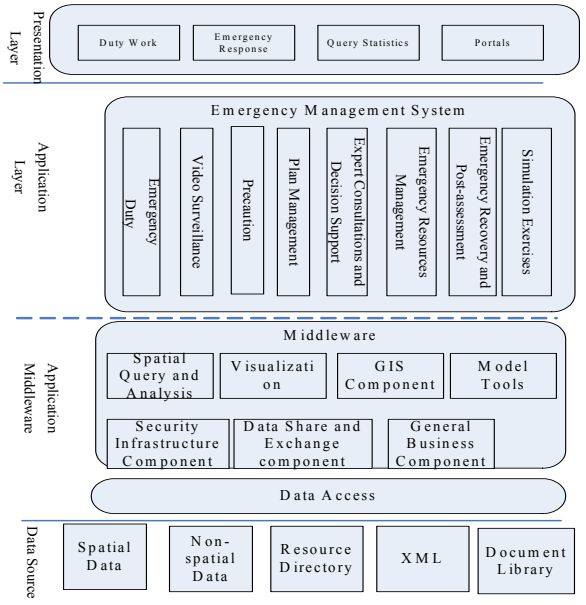

Figure 1 the Overall System Architecture